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Filed April 30, 2001

Gregory P. Matthews
Charles H. Folkerts

Group 3747

**METHOD AND APPARATUS FOR OBTAINING
A CONSISTENT PEDAL POSITION FOR A
VEHICLE HAVING DISPLACEMENT ON
DEMAND**

Examiner Stuart Carl Miller

AFFIDAVIT UNDER 37 CFR 1.131

Commissioner for Patents
PO Box 1450
Alexandria VA 22313-1450

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TECHNOLOGY CENTER R3700

Gregory P. Matthews, being duly sworn, deposes and says:

Charles H. Folkerts, being duly sworn, deposes and says:

1. I am an inventor of claims 1-14 of the patent application identified above and an inventor of the subject matter described and claimed therein.

2. Prior to November 20, 2000, having earlier conceived of the idea for the claimed invention "Method and apparatus for obtaining a consistent pedal position for a vehicle having an engine with displacement on demand," and with due diligence, I reduced the invention in the United States as evidenced by the attached invention disclosure form and documentation. The dates have been redacted from the invention disclosure and documentation.

3. That all statements made above of my own knowledge are believed to be true.

Gregory P. Matthews
Gregory P. Matthews

Charles H. Folkerts
Charles H. Folkerts

Subscribed and sworn to before me this 6TH day of AUGUST, ~~2004~~ 2004

Stephen R. Kornblum
Notary Public

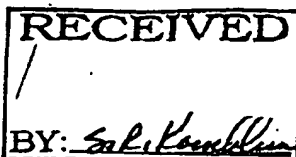
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STEPHEN R. KORNBLUM
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MY COMMISSION EXPIRES Apr 4, 2007



CONFIDENTIAL AND PRIVILEGED

GENERAL MOTORS
CORPORATION

File No.

GP-300996
DTE2000092

RECORD OF INVENTION

This Record of Invention must be completed with sufficient detail so that your invention can be understood and evaluated by both your engineering management and by a GM Legal Staff patent attorney. Novelty and competitive significance of your invention will be evaluated based on the information you provide.

Invention Title: Method for obtaining a consistent pedal-position to vehicle-response for engines with variable displacement

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Inventor #2*
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* If there are more than two (2) inventors for this invention use the template at the end of this form.

Rev. 5/00

LEGAL STAFF

1 of 6

Answer questions 1 - 8, completing all of them to the best of your knowledge.

1. This invention was first thought of on: _____

2. This invention has been or is expected to be disclosed outside GM on: _____ In all deac vehicles as of _____

3. This invention has been used or is committed to be used in production on: _____

4. This invention has been offered for sale outside GM on: _____

5. Was this invention made while working on a Government Contract? ☐ Yes ☒ No

If yes, identify the government Contract No. _____

6. Identify the product or process in which the invention is incorporated: _____

7. List all individuals who can provide information about the making of the invention. This list may include individuals who made the first sketch, description, or tests and individuals who are familiar with the facts relating to the making of the invention.

Jeff Allen, Allen Rayl, and Alex Roberts

8. Each inventor has a legal duty to disclose all information known that is material to patentability of this invention. Such information includes the relevant prior art, which may be in the form of current or past products, equipment, processes, materials, patents, publications, advertisements, displays, and unpublished developments and proposals—whether originated by you, others in GM, competitors, suppliers, customers or others. Such information also includes disclosure of this invention outside GM, sales and offers of products using this invention, use of this invention in production and disputes about who should be considered as an inventor of this invention. To comply with the duty to disclose, list here and attach a copy of all such information, to the extent known.

Answer question 9 thoroughly.

9. Describe the invention in sufficient detail so that its nature, operation and usefulness can be understood. (Attach drawings, diagrams and further description, when necessary. Additional guidelines are listed below.)

Displacement on Demand (DOD) engines have the ability to run on either all cylinders, or on half of the cylinders to save fuel, if there is sufficient torque available. When the engine runs on half of the cylinders, the throttle position relates to vehicle performance differently from when the engine runs on all cylinders. This invention converts pedal position to the appropriate throttle position commands such that the engine torque produced is independent of the number of cylinders running. This allows smooth and consistent power delivery to the vehicle.

The following algorithm controls the acceleration pedal to vehicle response characteristics for DOD engines. This algorithm is easy to calibrate. It consists of seven elements, which are shown in figure 1.

1 A reference torque model: based on the full engine displacement, an engine torque map is developed which determines the amount of torque that the driver is requesting

2 A function which converts the desired engine torque to a desired mass of air per cylinder (MAC).

3 A function which converts the desired engine torque to the nominal required throttle position, which would nominally result in the desired MAC as computed in 2 above..

4 A cylinder mass air (MAC) servo, which operates in a closed-loop mode to insure that the requested mass of air per cylinder is achieved. Since under nominal conditions torque is proportional to the mass of air inducted into the engine, this component assures that the desired torque is achieved. Thus, the MAC servo determines a throttle position correction necessary to achieve the desired MAC. This throttle position correction component compensates for vehicle-to-vehicle differences, throttle wear, and other variations in the throttle flow characteristics.

5 A summer to add the throttle position corrections to the nominal required throttle position.

6 PCM software which controls all other functions of the engine and transmission.

7 The engine under control.

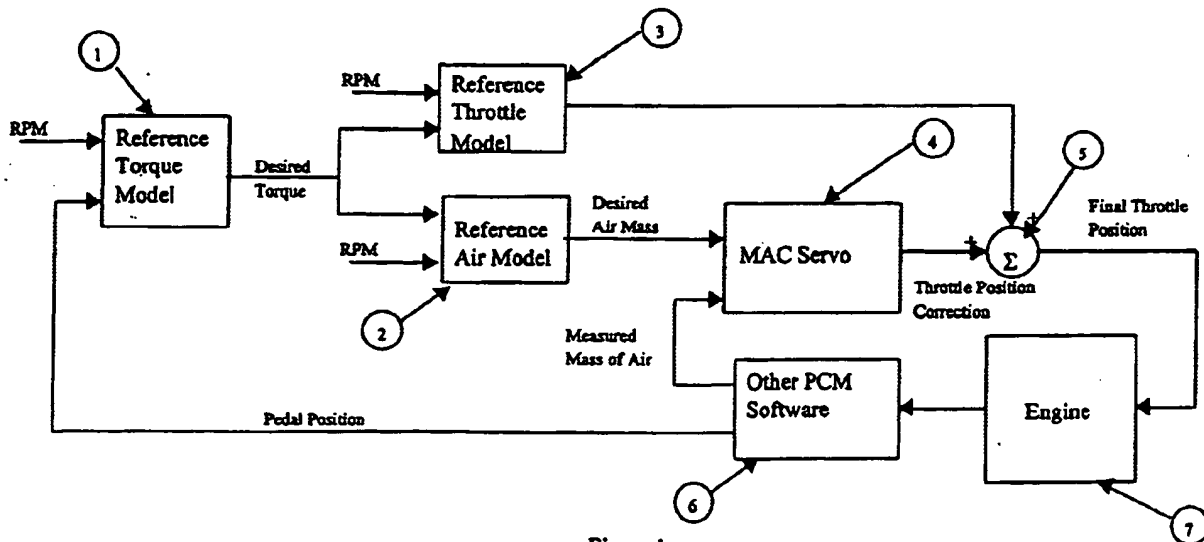


Figure 1:

Answer the following questions if helpful in describing this Invention

10. What benefits will be realized by using this invention?

This invention provides a simple, yet effective, method of allowing the driver to obtain the same pleasing driving response independent of the number of cylinders actually being used. When the engine operates on all cylinders the vehicle performs as well as a conventional vehicle. However, if there is enough engine torque available to provide the same pleasing driveability when operating on less than the full number of cylinders the engine can operate on less cylinders. This invention allows rapid calibration so that the vehicle will perform as well on less cylinders -- as long as the requested engine torque is available. This will significantly reduce development cost, improve driver perceived quality when operating on less than all cylinders. It will act as if it were running on all cylinders, as long as the reduced number of cylinders can produce sufficient power.

11. What is the state of development of this invention?

The algorithm is nearing the end of phase 00 and production software specifications are being written. Production code should be complete before the end of the

12. To the extent known, what alternatives exist for accomplishing substantially the same result as this invention?

Two complete sets of throttle progression functions could provide the same result when operating in either V8 or V4 mode. With proper calibration it might even be possible to make a smooth transition between 4 and 8 cylinder operation at a given pedal position. However, this method is much more difficult to calibrate and is not robust to variations between vehicles, unless a MAC servo was implemented.

13. Describe the background of the invention. This description may include the state of the prior art and may identify deficiencies in the prior art that are overcome by this invention.

Existing throttle control logic typically uses a mapping between pedal and throttle position, which is selected to achieve the desired driving feel. For this invention we would map the pedal to engine torque and then to throttle position. The two step process allows us to select different throttle positions for the same pedal position depending on the number of cylinders, which are being used. The throttle position would be different but the engine would generate the same amount of torque, thus giving the driver the same feel, independent of the number of cylinders being used.

I hereby assign this invention to General Motors Corporation
and authorize General Motors Corporation to file an application on my behalf.

Gregory P. Matthews
INVENTOR - SIGNATURE

Gregory P. Matthews
(ALSO, PRINT NAME)

Charles H. Folkerts
INVENTOR - SIGNATURE

Charles H. Folkerts
(ALSO, PRINT NAME)

DATE

INVENTOR - SIGNATURE

(ALSO, PRINT NAME)

DATE

This invention was reviewed and understood by me:

Douglas J. Babcock
1st WITNESS - SIGNATURE

Douglas J. Babcock
(ALSO PRINT NAME)

DATE

Sharon Liu
2nd WITNESS - SIGNATURE

Sharon Liu
(ALSO, PRINT NAME)

DATE

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